

Notice of Allowability

Application No.

10/731,603

Applicant(s)

KILIAN ET AL.

Examiner

Art Unit

Lev I. Iwashko

2186

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 4/20/2006.
2. ☐ The allowed claim(s) is/are 1,3-11,13-21 and 23-42.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some* c) ☐ None of the:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input checked="" type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date <u>6/26/2006</u> . |
| 3. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date <u>5/2/2006</u> | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____ |


TUAN V. THAI
PRIMARY EXAMINER

DETAILED ACTION

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.
2. Authorization for this examiner's amendment was given in a telephone interview with Richard Giunta on 6/26/2006.
3. The following are Claims 1-42 as they should appear in amended form:
 1. (Amended) A method of processing data in a computer system comprising at least one host and at least one content addressable storage system which stores data for the at least one host, wherein the at least one host accesses data units stored on the at least one storage system using content addresses generated based on the content of the data units, the method comprising an act of:
 - (a) in response to an access request from the at least one host computer for a unit of data identified by a content address including a plurality of bits, parsing the content address bits to determine at least one aspect of a physical storage location for the unit of data on the at least one storage system;
wherein the at least one storage system includes a plurality of storage nodes, and wherein the act (a) further comprises an act of parsing the content address bits to determine which of the plurality of storage nodes includes the physical storage location for the unit of data.
 2. (Cancelled).
 3. (Amended) The method of claim [2] 1, wherein at least some of the plurality of storage nodes include a plurality of disks, and wherein the act (a) further comprises an act

of parsing the content address to determine which of the plurality of disks includes the physical storage location for the unit of data.

4. (Original) The method of claim 1, wherein the act (a) is performed in response to a request to retrieve the unit of data from the at least one storage system, and wherein the method further comprises an act of passing the unit of data to the at least one host.

5. (Original) The method of claim 1, wherein the act (a) is performed in response to a request to write the unit of data to the at least one storage system.

6. (Original) The method of claim 5, further comprising an act of storing the unit of data at least partially at the physical storage location.

7. (Original) The method of claim 5, further comprising acts of:
applying an algorithm to determine a specified physical storage location based on the content address;
determining whether the specified physical storage location is suitable to store the unit of data, and when it is not, performing acts of:
storing the unit of data at a different physical storage location; and
storing a pointer to the different physical storage location at the specified physical storage location.

8. (Original) The method of claim 7, further comprising acts of:
moving the unit of data from the different physical storage location to the specified storage location; and
deleting the pointer to the different physical storage location.

9. (Original) The method of claim 1, wherein the storage system comprises a plurality of storage nodes, and wherein the method further comprises an act of assigning, to at least one of the plurality of storage nodes, a range of content addresses so that the at

least one of the plurality of storage nodes is assigned to store a plurality of units of data having content address within the range of content addresses.

10. (Original) The method of claim 1, further comprising an act of determining the physical storage location of the unit of data solely by the act of parsing and without performing an index lookup.

11. (Amended) At least one computer readable medium encoded with instructions that, when executed on a computer system perform, a method of processing data, wherein the computer system comprises at least one host and at least one content addressable storage system which stores data for the at least one host, and wherein the at least one host accesses data units stored on the at least one storage system using content addresses generated based on the content of the data units, the method comprising an act of:

(a) in response to an access request from the at least one host computer for a unit of data identified by a content address, parsing the content address to determine at least one aspect of a physical storage location for the unit of data on the at least one storage system;

wherein the at least one storage system includes a plurality of storage nodes, and wherein the act (a) further comprises an act of parsing the content address to determine which of the plurality of storage nodes includes the physical storage location for the unit of data.

12. (Cancelled).

13. (Amended) The at least one computer readable medium of claim [12] 11, wherein at least some of the plurality of storage nodes include a plurality of disks, and wherein the act (a) further comprises an act of parsing the content address to determine which of the plurality of disks includes the physical storage location for the unit of data.

14. (Original) The at least one computer readable medium of claim 11, wherein the act (a) is performed in response to a request to retrieve the unit of data from the at least one storage system, and wherein the method further comprises an act of passing the unit of data to the at least one host.

15. (Original) The at least one computer readable medium of claim 11, wherein the act (a) is performed in response to a request to write the unit of data to the at least one storage system.

16. (Original) The at least one computer readable medium of claim 15, wherein the method further comprises an act of storing the unit of data at least partially at the physical storage location.

17. (Original) The at least one computer readable medium of claim 15, wherein the method further comprises acts of:

- applying an algorithm to determine a specified physical storage location based on the content address;

- determining whether the specified physical storage location is suitable to store the unit of data, and when it is not, performing acts of:

- storing the unit of data at a different physical storage location; and

- storing a pointer to the different physical storage location at the specified physical storage location.

18. (Original) The at least one computer readable medium of claim 17, wherein the method further comprises acts of:

- moving the unit of data from the different physical storage location to the specified storage location; and

- deleting the pointer to the different physical storage location.

19. (Original) The at least one computer readable medium of claim 11, wherein the storage system comprises a plurality of storage nodes, and wherein the method further comprises an act of assigning, to at least one of the plurality of storage nodes, a range of content addresses so that the at least one of the plurality of storage nodes is assigned to store a plurality of units of data having content address within the range of content addresses.

20. (Original) The at least one computer readable medium of claim 11, wherein the method further comprises an act of determining the physical storage location of the unit of data solely by the act of parsing and without performing an index lookup.

21. (Amended) A content addressable storage system for use in a computer system, including the content addressable storage system and at least one host, wherein the at least one host accesses data units stored on the content addressable storage system using content addresses generated based on the content of the data units, the content addressable storage system comprising:

at least one storage device to store data received from the at least one host; [and]

at least one controller that, in response to an access request from the at least one host computer for a unit of data identified by a content address, parses the content address to determine at least one aspect of a physical storage location for the unit of data on the at least one storage system; and

a plurality of storage nodes that comprise the at least one storage device;

wherein the at least one controller parses the content address to determine which of the plurality of storage nodes includes the physical storage location for the unit of data

22. (Cancelled).

23. (Amended) The content addressable storage system of claim [22] 21, wherein at least some of the plurality of storage nodes include a plurality of disks, and wherein the at

least one controller parses the content address to determine which of the plurality of disks includes the physical storage location for the unit of data.

24. (Original) The content addressable storage system of claim 21, wherein the at least one controller parses the content address in response to a request to retrieve the unit of data from the at least one storage system, and wherein the controller passes the unit of data to the at least one host.

25. (Original) The content addressable storage system of claim 21, wherein the at least one controller parses the content address in response to a request to write the unit of data to the at least one storage system.

26. (Original) The content addressable storage system of claim 25, wherein the at least one controller stores the unit of data at the physical storage location.

27. (Original) The content addressable storage system of claim 25, wherein the at least one controller:

- applies an algorithm to determine a specified physical storage location based on the content address;

- determines whether the specified physical storage location is suitable to store the unit of data, and when it is not:

- stores the unit of data at a different physical storage location; and

- stores a pointer to the different physical storage location at the specified physical storage location.

28. (Original) The content addressable storage system of claim 27, wherein the at least one controller:

- moves the unit of data from the different physical storage location to the specified storage location; and

- deletes the pointer to the different physical storage location.

29. (Original) The content addressable storage system of claim 21, further comprising a plurality of storage nodes that comprise the at least one storage device, wherein the controller assigns, to at least one of the plurality of storage nodes, a range of content addresses so that the at least one of the plurality of storage nodes is assigned to store a plurality of units of data having content address within the range of content addresses.

30. (Original) The content addressable storage system of claim 21, wherein the controller determines the physical storage location of the unit of data solely by parsing the content address and without performing an index lookup.

31. (Original) A method of processing data in a computer system comprising at least one host and at least one content addressable storage system which stores data for the at least one host, wherein the at least one host accesses data units stored on the at least one storage system using a plurality of bits in content addresses generated based on the content of the data units, the method comprising acts of:

(a) receiving, from the host, a request to store a unit of data on the storage system, the unit of data having a content address based on the content of the unit of data;

(b) determining, based on the bits of the content address, a first storage location on the storage system to which the content address maps;

(c) storing a pointer for the first unit of data at the first storage location, the pointer pointing to a second storage location; and

(d) storing the unit of data at the second storage location on the storage system.

32. (Original) The method of claim 31, wherein the act (d) is performed before the acts (b) and (c).

33. (Original) The method of claim 31, further comprising acts of:

- (e) receiving, from the host, a request to retrieve the unit of data, the request including a content address of the unit of data;
- (f) mapping the content address to the first storage location;
- (g) retrieving the pointer from the first storage location; and
- (h) using the pointer to access the second storage location and retrieve the unit of data from the second storage location.

34. (Original) The method of claim 31, further comprising acts of:

- (i) periodically searching the at least one storage system for pointers to other storage locations on the storage system which store units of data; and
- (j) determining whether any of the pointers to other storage locations can be replaced with their corresponding units of data.

35. (Original) At least one computer readable medium encoded with instructions that, when executed on a computer system, perform a method of processing data, wherein the computer system comprises at least one host and at least one content addressable storage system which stores data for the at least one host, and wherein the at least one host accesses data units stored on the at least one storage system using a plurality of bits of the content addresses generated based on the content of the data units, the method comprising acts of:

- (a) receiving, from the host, a request to store a unit of data on the storage system, the unit of data having a content address based on the content of the unit of data;
- (b) determining, based on the bits of the content address, a first storage location on the storage system to which the content address maps;
- (c) storing a pointer for the first unit of data at the first storage location, the pointer pointing to a second storage location; and
- (d) storing the unit of data at the second storage location on the storage system.

36. (Original) The at least one computer readable medium of claim 35, wherein the act (d) is performed before the acts (b) and (c).

37. (Original) The at least one computer readable medium of claim 35, wherein the method further comprises acts of:

- (e) receiving, from the host, a request to retrieve the unit of data, the request including a content address of the unit of data;
- (f) mapping the content address to the first storage location;
- (g) retrieving the pointer from the first storage location; and
- (h) using the pointer to access the second storage location and retrieve the unit of data from the second storage location.

38. (Original) The at least one computer readable medium of claim 35, wherein the method further comprises acts of:

- (i) periodically searching the at least one storage system for pointers to other storage locations on the storage system which store units of data; and
- (j) determining whether any of the pointers to other storage locations can be replaced with their corresponding units of data.

39. (Original) A content addressable storage system for use in a computer system that includes at least one host, wherein the at least one host accesses data units stored on the content addressable storage system using a plurality of bits in content addresses generated based on the content of the data units, the content addressable storage system comprising:

- at least one storage device to store data received from the at least one host; and
- at least one controller that:
 - receives, from the host, a request to store a unit of data on the storage system, the unit of data having a content address based on the content of the unit of data;
 - determines, based on the bits of the content address, a first storage location on the storage system to which the content address maps;
 - stores a pointer for the first unit of data at the first storage location, the pointer pointing to a second storage location; and

stores the unit of data at the second storage location on the storage system.

40. (Original) The content addressable storage system of claim 39, wherein the controller stores the unit of data at the second storage location on the storage system before determining the first storage location and storing the pointer.

41. (Original) The content addressable storage system of claim 39, wherein the controller further:

receives, from the host, a request to retrieve the unit of data, the request including a content address of the unit of data;

maps the content address to the first storage location;

retrieves the pointer from the first storage location; and

uses the pointer to access the second storage location and retrieve the unit of data from the second storage location.

42. (Original) The content addressable storage system of claim 39, wherein the controller is adapted to:

periodically search the at least one storage system for pointers to other storage locations on the storage system which store units of data; and

determine whether any of the pointers to other storage locations can be replaced with their corresponding units of data.

Allowable Subject Matter

4. Claims 1, 3-11, 13-21, and 23-42 are allowed.

5. Claims 2, 12, and 22 are cancelled.

6. The following is an examiner's statement of reasons for allowance: This invention refers to utilizing intrinsic locations to select a storage location for newly written data based on an address of the data in content addressable memory. The examiner attended an Applicant-

initiated telephonic interview, where the applicant brought up a possible amendment to the claims that would make the claims novel. Upon review of the proposed amendments, the Examiner agreed that the proposed amendments were almost in condition for allowance. The Examiner then made a final Examiner Amendment for claims 1-3, 11-13, 21-23, 31, 35, and 39 as shown above.

7. Claims 1, 11, 21, 31, 35, and 39 differ only in being different embodiments of the invention (method, system, or apparatus). Otherwise, the aforementioned claims teach the same concepts. The allowability of Claim 1 will be discussed in detail, with the explanation applying to Claims 11, 21, 31, 35, and 39 as well. The scope of Claim 1 includes a content addressable storage system that stores data for a host, and the host is able to access the data based on the actual contents of the data units. The novelty of this invention comes into effect when the data identified by a content address includes a plurality of bits, as well as the fact that the actual contents of the data units are being accessed. Furthermore, there is an act of parsing the content address bits to determine which of the plurality of storage nodes includes the physical storage location for the unit of data. The fact remains that parsing the bits of a content addressable storage remains a novel notion, and therefore Claim 1 is allowable.

8. All other claims dependent on Claims 1, 11, 21, 31, 35, and 39 are therefore in condition for allowance due to their dependence on the allowable parent claims.

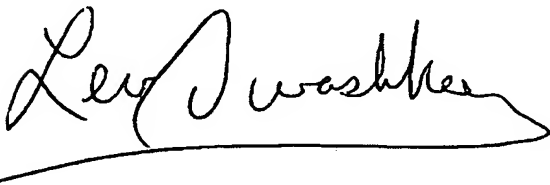
9. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

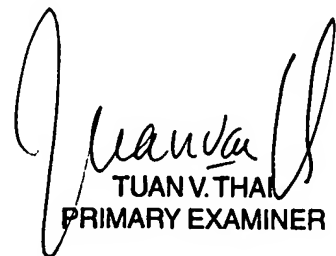
10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lev I. Iwashko whose telephone number is (571)272-1658. The examiner can normally be reached on M-Th from 8AM-6PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matt Kim can be reached on (571)272-4182. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Lev Iwashko



TUAN V. THAI
PRIMARY EXAMINER